

WHAT IS CLAIMED IS:

1. An optical film comprising diffraction grating cells arranged in a matrix, each cell comprising blazed type or binary type curved gratings.

5 2. The optical film according to claim 1, wherein said gratings contain different profiles.

3. The optical film according to claim 1, wherein said gratings contain the same profile and arranged in parallel with each other.

10 4. The optical film according to one of claims 1 to 3, wherein said gratings include at least two grating pitches.

15 5. The optical film according to one of claims 1 to 3, wherein an angle of a slope of the gratings is uniform.

6. The optical film according to one of claims 1 to 3, wherein a surface of said diffraction grating cells is provided with a reflection layer.

20 7. The optical film according to one of claims 1 to 3, wherein the grating has a gentle slope and a steep slope in a cross section and a surface of the gentle slope is provided with a reflection layer.

25 8. The optical film according to one of claims 1 to 3, wherein fine rectangular or elliptic projections or recesses are formed on a surface of said diffraction grating cells with a short axis thereof agreeing with a direction of juxtaposition of said gratings.

9. A display device comprising:

a liquid crystal display layer which forms an image to be displayed; and

5 a light reflecting optical film which is arranged on a rear surface of the liquid crystal display layer and comprises diffraction grating cells arranged in a matrix, each cell comprising blazed type or binary type curved gratings.

10 10. The display device according to claim 9, wherein said gratings contain different profiles.

11. The display device according to claim 9, wherein said gratings contain the same profile and arranged in parallel with each other.

15 12. The display device according to one of claims 9 to 11, wherein said gratings include at least two grating pitches.

13. The display device according to one of claims 9 to 11, wherein an angle of a slope of the gratings is uniform.

20 14. The display device according to one of claims 9 to 11, wherein a surface of said diffraction grating cells is provided with a reflection layer.

25 15. The display device according to one of claims 9 to 11, wherein the grating has a gentle slope and a steep slope in a cross section and a surface of the gentle slope is provided with a reflection layer.

16. The display device according to one of

claims 9 to 11, wherein fine rectangular or elliptic projections or recesses are formed on a surface of said diffraction grating cells with a short axis thereof agreeing with a direction of juxtaposition of said gratings.

17. The display device according to one of claims 9 to 11, wherein

said liquid crystal display layer comprises pixels arranged in a matrix; and

10 said diffraction grating cells and said pixels show a one-to-one correspondence.

18. The display device according to one of claims 9 to 11, wherein

15 said liquid crystal display layer comprises pixels arranged in a matrix; and

a pitch of arrangement of said diffraction grating cells is integer times of a pitch of arrangement of said pixels or vice versa.

19. The display device according to one of claims 9 to 11, wherein the grating has a gentle slope and a steep slope in a cross section and the gentle slope is directed to above a display screen of said display device.

20. A display device comprising:

25 a liquid crystal display layer which forms an image to be displayed; and

a light transmission optical film which is

arranged on a front surface of the liquid crystal display layer and comprises diffraction grating cells arranged in a matrix, each cell comprising blazed type or binary type curved gratings.

5 21. The display device according to claim 20, wherein said gratings contain different profiles.

22. The display device according to claim 20, wherein said gratings contain the same profile and arranged in parallel with each other.

10 23. The display device according to one of claims 20 to 22, wherein said gratings include at least two grating pitches.

15 24. The display device according to one of claims 20 to 22, wherein an angle of a slope of the gratings is uniform.

20 25. The display device according to one of claims 20 to 22, wherein fine rectangular or elliptic projections or recesses are formed on a surface of said diffraction grating cells with a short axis thereof agreeing with a direction of juxtaposition of said gratings.

26. The display device according to one of claims 20 to 22, wherein

25 said liquid crystal display layer comprises pixels arranged in a matrix; and

 said diffraction grating cells and said pixels show a one-to-one correspondence.

27. The display device according to one of claims 20 to 22, wherein

said liquid crystal display layer comprises pixels arranged in a matrix; and

5 a pitch of arrangement of said diffraction grating cells is integer times of a pitch of arrangement of said pixels or vice versa.

28. The display device according to one of claims 20 to 22, wherein the grating has a gentle slope and a steep slope in a cross section and the gentle slope is directed to above a display screen of said display device.

29. The display device according to one of claims 20 to 22, wherein fine rectangular or elliptic projections or recesses are formed on a surface of said diffraction grating cells with a short axis thereof agreeing with a direction of juxtaposition of said gratings.

30. An optical film comprising:
20 diffraction grating cells arranged in a matrix, each cell comprising curved gratings, wherein said gratings include at least two grating pitches.

31. The optical film according to claim 30, wherein said diffraction grating cells are blazed type diffraction grating cells.

32. The optical film according to claim 30, wherein said diffraction grating cells are binary type

diffraction grating cells.

33. The optical film according to one of claims 30 to 32, wherein, a pitch d_y of arrangement of the gratings is changed in a cell so as to change either
5 α_y or the tangent of α_y stepwise by a constant value, wherein θ is an angle in the vertical direction at which incident light enters the diffraction grating cells, α_y is an angle in the vertical direction at which diffracted light emits from the diffraction
10 grating cells, and $\lambda (= d_y \times (\sin \theta + \sin \alpha_y))$ is a wavelength of diffracted light.

34. The optical film according to one of claims 30 to 32, wherein a pitch of arrangement of the gratings in a diffraction grating cell is constant and a pitch
15 d_y of arrangement of the gratings is changed from cell to cell so as to change either α_y or the tangent of α_y stepwise by a constant value, wherein θ is an angle in the vertical direction at which incident light enters the diffraction grating cells, α_y is an angle in the
20 vertical direction at which diffracted light emits from the diffraction grating cells, and $\lambda (= d_y \times (\sin \theta + \sin \alpha_y))$ is a wavelength of diffracted light.

35. The optical film according to one of claims 30 to 32, wherein a pitch of arrangement of the gratings
25 in a diffraction grating cell is constant and there are at least two grating pitches of arrangement of the gratings among the diffraction grating cells, a

difference of the pitches being not greater than a value corresponding to the half-width of light diffracted by the cell or a value corresponding to the width of light diffracted by the cell.

5 36. The optical film according to one of claims 30 to 32, wherein said gratings contain the same profile and arranged in parallel with each other.

10 37. The optical film according to one of claims 30 to 32, wherein an angle of a slope of the gratings is uniform.

15 38. The optical film according to one of claims 30 to 32, wherein a surface of said diffraction grating cells is provided with a reflection layer.

20 39. The optical film according to one of claims 30 to 32, wherein the grating has a gentle slope and a steep slope in a cross section and a surface of the gentle slope is provided with a reflection layer.

25 40. The optical film according to one of claims 30 to 32, wherein fine rectangular or elliptic projections or recesses are formed on a surface of said diffraction grating cells with a short axis thereof agreeing with a direction of juxtaposition of said gratings.

41. A display device comprising:

25 a liquid crystal display layer which forms an image to be displayed; and

 a light reflecting optical film which is arranged on a rear surface of the liquid crystal display layer

and comprises diffraction grating cells arranged in a matrix, each cell comprising curved gratings, wherein said gratings include at least two grating pitches.

5 42. The display device according to claim 41, wherein said gratings contain different profiles.

43. The display device according to claim 41, wherein said gratings contain the same profile and arranged in parallel with each other.

10 44. The display device according to one of claims 41 to 43, wherein said gratings include at least two grating pitches.

45. The display device according to one of claims 41 to 43, wherein an angle of a slope of the gratings is uniform.

15 46. The display device according to one of claims 41 to 43, wherein a surface of said diffraction grating cells is provided with a reflection layer.

20 47. The display device according to one of claims 41 to 43, wherein the grating has a gentle slope and a steep slope in a cross section and a surface of the gentle slope is provided with a reflection layer.

25 48. The display device according to one of claims 41 to 43, wherein fine rectangular or elliptic projections or recesses are formed on a surface of said diffraction grating cells with a short axis thereof agreeing with a direction of juxtaposition of said gratings.

49. The display device according to one of claims 41 to 43, wherein

said liquid crystal display layer comprises pixels arranged in a matrix; and

5 said diffraction grating cells and said pixels show a one-to-one correspondence.

50. The display device according to one of claims 41 to 43, wherein

10 said liquid crystal display layer comprises pixels arranged in a matrix; and

a pitch of arrangement of said diffraction grating cells is integer times of a pitch of arrangement of said pixels or vice versa.

15 51. The display device according to one of claims 41 to 43, wherein the grating has a gentle slope and a steep slope in a cross section and the gentle slope is directed to above a display screen of said display device.

52. A display device comprising:

20 a liquid crystal display layer which forms an image to be displayed; and

25 a light transmission optical film which is arranged on a front surface of the liquid crystal display layer and comprises diffraction grating cells arranged in a matrix, each cell comprising blazed type or binary type curved gratings.

53. The display device according to claim 52,

wherein said gratings contain different profiles.

54. The display device according to claim 52, wherein said gratings contain the same profile and arranged in parallel with each other.

5 55. The display device according to one of claims 52 to 54, wherein said gratings include at least two grating pitches.

10 56. The display device according to one of claims 52 to 54, wherein an angle of a slope of the gratings is uniform.

15 57. The display device according to one of claims 52 to 54, wherein fine rectangular or elliptic projections or recesses are formed on a surface of said diffraction grating cells with a short axis thereof agreeing with a direction of juxtaposition of said gratings.

58. The display device according to one of claims 52 to 54, wherein

20 said liquid crystal display layer comprises pixels arranged in a matrix; and

said diffraction grating cells and said pixels show a one-to-one correspondence.

59. The display device according to one of claims 52 to 54, wherein

25 said liquid crystal display layer comprises pixels arranged in a matrix; and

a pitch of arrangement of said diffraction grating

cells is integer times of a pitch of arrangement of said pixels or vice versa.

- 5 60. The display device according to one of claims 52 to 54, wherein the grating has a gentle slope and a steep slope in a cross section and the gentle slope is directed to above a display screen of said display device.

10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
350
360
370
380
390
400
410
420
430
440
450
460
470
480
490
500
510
520
530
540
550
560
570
580
590
600
610
620
630
640
650
660
670
680
690
700
710
720
730
740
750
760
770
780
790
800
810
820
830
840
850
860
870
880
890
900
910
920
930
940
950
960
970
980
990